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Dwellers, (7) The Pacific Coast. A general scheme is followed in the treatment of these seven divisions. The tribes dwelling within a division are named; the environment indicated; cosmogony outlined; the deified powers and mythic characters mentioned; and the beliefs, legends, stories, briefly set forth. By such a broad sketch of each, the seven divisions are presented in the eleven chapters of the book.

Professor Alexander in his "Introduction," remarks (p. xv):

"Mythology in the classical acceptation can scarcely be said to exist in North America; but in quite another sense—a belief in more or less personified nature-powers and the possession of stories narrating the deeds and adventures of these persons—the Indians own, not one but many mythologies; for every tribe and often within the tribe, each clan and society, has its individual mythic lore." This statement he qualifies and adds the following discriminating observation. "Beliefs vary from tribe to tribe, even from clan to clan, yet there are fundamental similarities and uniformities that afford a basis for a kind of critical reconstruction of a North American mythology. No single tribe and no group of tribes has completely expressed this mythology—much less has any realized its form; but the student of Indian lore can scarcely fail to become conscious of a coherent system of myths, of which the Indians themselves might have become aware in the course of time, if the intervention of Old-Word ideas had not confused them." On p. xvi the author wisely says: "In America, no more than in the Old World, are we to identify religion with mythology. The two are intimately related; every mythology is in some degree an effort to define a religion." Attention is called to the fact that "the powers which evoke the Indian's deepest veneration are of rare appearance in the tales," and adds: "The Indian's religion must be studied in his rites rather than in his myths." On p. xviii we read: "Inevitably these powers (of nature) find a fluctuating representation in the varying imagery of myth. Consistency is not demanded, for the Indian's mode of thought is too deeply symbolic for him to regard his own stories as literal; they are neither allegory nor history; they are myth with a truth midway between that of allegory and that of history. . . . The vast majority (of Indian stories) are obviously told for entertainment; they represent an art, the art of fiction; and they fall into the classes of fiction, satire and humor, romance, adventure. Again, not a few are moral allegories, or they are fables with obvious lessons. . . . Myths that detail causes are science in infancy and they are perhaps the only stories that may properly be called myths."

Space forbids further quotation of the many discerning observations or deductions scattered throughout the pages.

One who knows something of the vast jumble of material that in this volume has been whipped into shape, can best appreciate the difficulty of the task essayed by the author and it is a pleasure to call attention to the breadth of culture and sympathy he has brought to its accomplishment. "The time will certainly come for a closely analytical comparative study of North American myths" he declares; and when that time arrives, may the task fall into equally competent hands, as the present volume.

This interesting and valuable book was not prepared for specialists, although it will be of service to such. To the general student of American history it presents a new and comprehensive view of ancient life and thought upon this continent.

ALICE C. FLETCHER

NOTES ON CANADIAN STRATIGRAPHY AND PALEONTOLOGY

CORDILLERAN PROVINCE

THE Rossland, British Columbia, mining camp is situated in the Columbia Range immediately north of the international boundary and west of the Columbia River. A recently published memoir by C. W. Drysdale,[1] al-

[1] "Geology and Ore Deposits of Rossland, B. C.," C. W. Drysdale, Geological Survey, Canada, Memoir 77, 1915.

though devoted in the main to a description of the ore deposits, gives much valuable information concerning the stratigraphy and geological history of the region. The oldest rocks are the slates, shales, quartzites, calcareous sediments, and tuffs of the Mt. Roberts formation, aggregating over 1,200 feet in thickness. A meager collection of fossils, collected by R. W. Brock and identified by H. M. Ami, indicates the Pennsylvanian age of the formation, but gives no clue to faunal relationships. The sediments are cut by intrusive and extrusive volcanic rocks of Triassic and Jurassic age; the whole region suffered orogenic uplift at the close of the last-named period. By the end of Cretaceous times it had been peneplained and was again deformed during the Laramide revolution. Stream gravels, probably of Eocene age, are known in two localities, but the major record of mid-Tertiary time is one of volcanic activity. By the close of the Pliocene period, a late mature topography of comparatively slight relief had been carved beneath the Cretaceous paleoplain and at that time the streams were rejuvenated by another epirogenic uplift. The greater part of the present relief is the result of Quaternary stream erosion aided by glaciation.

The agricultural development of the Prairie Provinces of Canada must inevitably bring an increasing demand for phosphates, although at the present time no deposits of mineral phosphate are being worked in the Dominion. In the hope that phosphate beds similar to those of the western United States might be discovered in Alberta and British Columbia, the Canadian Conservation Commission delegated F. D. Adams and W. J. Dick to make a reconnaissance of favorable localities during the 1915 field season. The report[2] of their work was published late in 1915—an enviable record for prompt publication by a government scientific bureau. Three lines of section across the Rocky Mountains were selected as possibly exposing strata similar to the phosphate-bearing Pennsylvanian terranes of Idaho and Montana. Relying solely upon paleontological evidence, it was speedily ascertained that two of these contained no rocks of Upper Carboniferous age and attention was centered upon the third area, the Rocky Mountains Park at Banff. By faunal analogy with the Montana field, 350 miles to the south, phosphate beds might be expected to occur near the contact of the Upper Banff limestone and the Rocky Mountain quartzite. Search was rewarded by the discovery of low-grade phosphate rock in place and one piece of high-grade "float," enough to demonstrate that careful prospecting in these horizons is justifiable. The report is concluded with a number of valuable suggestions for prospectors and a summary of the phosphate resources of the world.

Recent field work carried on in the Canadian Rockies by L. D. Burling[3] has resulted in important additions to our knowledge of Paleozoic stratigraphy in that region. The ammonite-bearing shales near Massive, west of Banff, Alberta, originally described as of Jurassic age[4] are now known to represent the Upper Banff shales, are probably of Permian age, and occupy the normal position above the Rocky Mountain quartzite. Devonian and Cambrian strata are in juxtaposition over an area of 5,000 square miles between Banff and Elko, British Columbia, although only a few miles to the northwest 10,000 feet of Ordovician and Silurian strata overly the Cambrian. The Albertella fauna is of especial interest because it is the oldest Cambrian fauna found in contact with the Beltian rocks of Montana and adjacent regions. It is now known to be of early Middle Cambrian age from its discovery in strata in Mount Bosworth, British Columbia, and elsewhere. The line between the Middle and Upper Cambrian was found over wide areas to be the locus of a pronounced emergence of the sea bottom,

[2] "Discovery of Phosphate of Lime in the Rocky Mountains," F. D. Adams and W. J. Dick, Commission of Conservation, Canada, Ottawa, 1915.

[3] "Notes on the Stratigraphy of the Rocky Mountains, Alberta and British Columbia," L. D. Burling, Geological Survey, Canada, Summary Report for 1915, 1916, pp. 97–100.

[4] Geological Survey, Canada, Guide Book 8, Pt. 2, 1913, p. 191.

while the Lower and Middle Cambrian are separated by a diastrophic break of considerable magnitude.

ORDOVICIAN FORMATIONS AND FAUNAS

Nearly half of the iron smelted in Canada is obtained from the Wabana iron ore deposits on Bell Island in Conception Bay, Newfoundland. Dr. A. O. Hayes, in a recently published memoir,[5] has given an excellent description of these ores and their occurrence. Oolitic iron ore with ferrugineous shales and sandstones forms part of a sedimentary series containing a fauna which correlates with the Arenig and lower Llandeilo stages of Wales, corresponding roughly to the Beekmantown, Chazy, and Black River of the Appalachian province. The spherules of ore are composed of alternating concentric layers of hematite and chamosite (a green iron silicate) and in many cases were pierced by living boring algæ. Algæ are found in all horizons in the ore beds and doubtless played an important part in the precipitation of these primary bedded ores. Practically all of the calcium and phosphorus of the ores is derived from linguloid brachiopod shells. Layers of oolitic pyrite associated with a graptolite fauna occur in the midst of the shales between two of the iron ore zones. These are interpreted as indicative of open ocean currents and deeper water. The chapters treating of the origin of these beds make use of many data obtained from recent studies of Drew, Doss, and others, concerning the chemical reactions induced by marine bacteria.

Epicontinental seas of Ordovician time were much more basin-like in character than was formerly supposed. Difficulties have frequently arisen from the fact that minor formation names were carried over wide expanses of territory without due examination of fossil faunas. Especially is this true of the strata deposited during the latter part of the period. Faunal studies by A. F. Foerste, now in progress, are yielding very important results concerning the so-called Lorraine and Richmond terranes of Ontario and Quebec.[6] The investigations embrace two general areas: that extending from the northern shore of Lake Ontario northwestward across Georgian Bay, and that east of the Frontenac axis in eastern Ontario and southern Quebec.

The faunas of the "Lorraine" formations in the more westerly of these two basins are so different from the typical Lorraine fauna of New York that the use of the term Lorraine can be of little value. The terms Maysville and Eden may prove much more appropriate, as these strata can probably be correlated with the formations so named in the vicinity of Cincinnati, Ohio, at least in a general way. Apparently the "Lorraine" of Ontario presents much more in common with the strata of a similar age in the Ohio basin than with the Lorraine of the province of Quebec. The latter is, also, faunally distinct from the New York Lorraine and evidently represents sedimentation in a somewhat isolated basin. Quite probably the Frontenac axis was sufficiently developed in later Ordovician time to form a faunal barrier along the southern and western border of the region in which accumulation of the Quebec Lorraine was being effected.

In neither of the Canadian provinces is there a definite line of demarcation between the "Lorraine" and Richmond. The Richmond fauna seems to have invaded the "Lorraine" seas gradually, a few species at a time, rather than *en masse*. The upper part of the so-called Lorraine of Ontario is doubtless of Richmond age. The Richmond includes also the Queenston shales, largely of a red color, which occur in eastern Ontario and Quebec as well as in the vicinity of Lake Ontario. These shales appear to be merely the estuarine representatives, along the southern margin of the Laurentian highlands, of marine strata elsewhere known as the Richmond formation. The Richmond fauna of the eastern basin has a decidedly western aspect and embraces only

[5] "Wabana Iron Ore of Newfoundland," A. O. Hayes, Geological Survey, Canada, Memoir 78, 1915.

[6] "Upper Ordovician Formations in Ontario and Quebec," A. F. Foerste, Geological Survey, Canada, Memoir 83, 1916.

a small element closely akin to the Richmondian of Anticosti Island. It is probable, however, that for a brief time open waterways afforded migration by way of some northern passage from Anticosti as far west as Manitoulin Island in Georgian Bay, for a small contingent in the Richmond fauna of the western basin seems to have been recruited from the St. Lawrence gulf.

OIL AND GAS FIELDS

Brief descriptions of the Paleozoic strata of southern Ontario and Quebec are included in a treatise upon the oil and gas fields of these provinces by Wyatt Malcolm.[7] All available drill records together with statistics of production are assembled and the occurrence of oil and gas with relation to rock structure is discussed. The oil production has steadily declined in recent years, but gas production has been rapidly increasing and the fields have been widely extended. Oil or gas, or both, have been found in the Onondaga, Salina, Guelph, Clinton, and Medina formations. The prospects for new fields are not very encouraging.

Similar summary descriptions of Paleozoic strata and the logs of wells drilled for oil and gas in Ontario are assembled by C. W. Knight[8] in the current report of the Ontario Bureau of Mines.

DEVONIAN FORMATIONS AND FAUNAS

In general, the introduction of a new fauna or faunal facies is of more importance in delineating stratigraphic boundaries than is the persistence of an old biota. Applying this principle to the basal Devonian strata in Ontario, it becomes necessary to place the Detroit River series in the Devonian rather than in the Silurian system. The evidence for this conclusion is presented by C. R. Stauffer in a paper[9] which may be considered as a postscript to the same author's memoir on the Devonian of Ontario.[10] The Detroit River, or Upper Monroe, series comprises four formations: the Lucas and Amherstburg dolomites, the Anderdon limestone, and the Flat Rock dolomite, named in descending order. The Amherstburg fauna is typically Devonian with strong Onondaga affinities, but the Lucas dolomite contains a large proportion of residual Silurian forms, many of which display little or no recognizable variation from their pre-Devonian ancestors. The erosion interval between the deposition of the Detroit River series and the overlying Onondaga limestone was a long one, so that the former is probably to be referred to the Helderbergian. The faunas are, however, so distinctive that they must have existed in an embayment, presumably from the north or northwest, which was altogether isolated from that of New York and adjacent states toward the east and south.

The Gaspé peninsula in Quebec rivals Anticosti Island in the significance of its record of mid-Paleozoic times. Not the least interesting of its sections is that of the escarpment of the Table-À-Rolante at Percé, which extends northwestward and southeastward from the Pic d'Aurore. John M. Clarke's description[11] of this exposure is artistically illustrated by a colored reproduction of the brilliant cliffs which overhang the Mal-Baie. The summit of the cliffs consists of horizontal strata of Bonaventure conglomerate, a typical "Old Red" sandstone of later Devonian, and possibly in part Mississippian, age. Unconformably underlying that formation are the Percé limestone and the Pic d'Aurore series. In the midst of the latter is a sandstone band carrying the typical sand fauna of the New York Oriskany. Faulted up at the east is a block of Barré limestone, of earliest Devonian age. Beneath the Devonian strata are highly contorted Silurian and Ordovician sediments. The shoal water Oriskany sands form a striking contrast to the lower portion

[7] "The Oil and Gas Fields of Ontario and Quebec," Wyatt Malcolm, Geological Survey, Canada, Memoir 81, 1915.

[8] "Oil and Gas in Ontario," C. W. Knight, Ontario Bureau Mines, 24th Ann. Rept., Pt. 2, 1915.

[9] *Bull. Geol. Soc. America*, Vol. 27, 1916, pp. 72–77.

[10] Geol. Surv., Canada, Memoir 34, 1915.

[11] N. Y. State Museum, Bull. 177, 1915, pp. 147–153.

of the Grande Grève limestone, which outcrops elsewhere on the peninsula and carries a similar Oriskany fauna of overgrown sand-loving invertebrates imprisoned in a calcareous matrix. As in New York, both the shallow and deep water facies of the Oriskany are present at Gaspé, but without the striking differences in faunal content. The Bonaventure conglomerate, in its lithology as well as in its structural relations to the underlying formations, bears testimony to the importance of the mid-Devonian orogeny in the northeastern Appalachian province. Dr. Clarke in another paper[12] in the same publication lays stress upon this diastrophy and couples with it the volcanic activity responsible for the Monteregian hills.

TRIASSIC FORMATIONS

Detailed descriptions of the Newark series, as exposed along the shores of Minas Basin and the Bay of Fundy, are given by Sidney Powers in an important contribution concerning the Acadian Triassic.[13] The area is the most northerly of the geo-synclinal basins developed in the Atlantic coastal province during the Triassic period and presents problems similar to those of the Connecticut Valley. Sedimentation was largely fluviatile, in the main resulting from the occasional floods of a hot dry climate. Fissure eruptions and volcanic ejections occurred at intervals during the accumulation of the sediments.

PLEISTOCENE (?) MAN IN BRITISH COLUMBIA

Fragments of a human skeleton were discovered in 1911 near Savona, B. C., in silt beds alleged to be of Pleistocene age. A claim of great antiquity for the skeleton was made before the Royal Society of Canada in May, 1915. The bones are those of an aged woman and display no characters that would distinguish them from those of a modern Shuswap Indian.[14] An investigation of the deposits from which the bones were obtained was undertaken by C. W. Drysdale. He reports[15] that the field evidence indicates the Recent age of the silts at the locality. There is, therefore, no basis for the belief that the Savona skeleton is a relic of Pleistocene man.

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September 7, 1916

12 N. Y. State Museum, Bull. 177, 1915, pp. 115–134.

13 *Jour. Geol.*, Vol. 24, Nos. 1, 2 and 3, 1916.

14 Knowles, F. H. S., Geol. Surv., Canada, Summary Report for 1915, 1916, pp. 281–283.

15 "Human Skeleton from Silt Bed near Savona, B. C.," C. W. Drysdale, Geological Survey, Canada, Summary Report for 1915, 1916, pp. 91–92.

METHODS OF CRITICISM OF "SOIL BACTERIA AND PHOSPHATES"[1]

A CIRCULAR letter, dated July 28, 1916, criticizing Bulletin 190 ("Soil Bacteria and Phosphates") of the University of Illinois Agricultural Experiment Station was sent to many editors of agricultural journals. This letter bears the signature of Dr. H. J. Wheeler, of the Agricultural Service Bureau of the American Agricultural Chemical Company.

The caption employed is as follows: "Confidential and Not For Publication." This will doubtless appear to those who welcome frank and open criticism as an entirely unwarranted and a highly undignified manner of criticism. No copy of this letter was received by us from Dr. Wheeler, but through the courtesy of the agricultural press the matter has reached us from many sources and from several different states.

The purpose of Dr. Wheeler's letter to the agricultural editors is evidently to belittle the importance of the discovery that the nitrifying bacteria have power to make rock phosphate soluble.

As space will not permit quoting in full the contents of this four-page letter, we quote only the statements under discussion. In the last paragraph of the first page, we read:

> The organic acids and the carbonic acid produced in the decomposition of vegetable matter or brought

1 SCIENCE, p. 246, August 18, 1916, and Bulletin 190, University of Illinois Agricultural Experiment Station.